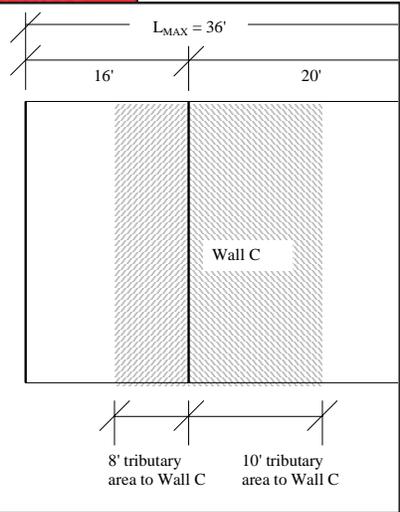
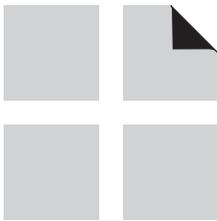


# INTERIOR SHEAR WALLS



## DESIGN AID No. 8

American  
Forest &  
Paper  
Association

# INTERIOR SHEAR WALLS

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# Introduction

This document describes how interior shear walls are designed to resist lateral loads. AF&PA’s *Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings, 2001 Edition* and *Special Design Provisions for Wind and Seismic (Wind & Seismic), 2005 Edition*, each provide design criteria for shear walls. However, emphasis is on exterior shear walls.

Note that design assumptions are different for wind loads versus seismic loads. While wind loads act primarily on the “skin” of the structure, seismic loads are developed internally due to weight of materials and components in the structure. Therefore, certain provisions for interior shear walls may only apply to seismic loads and not wind loads.

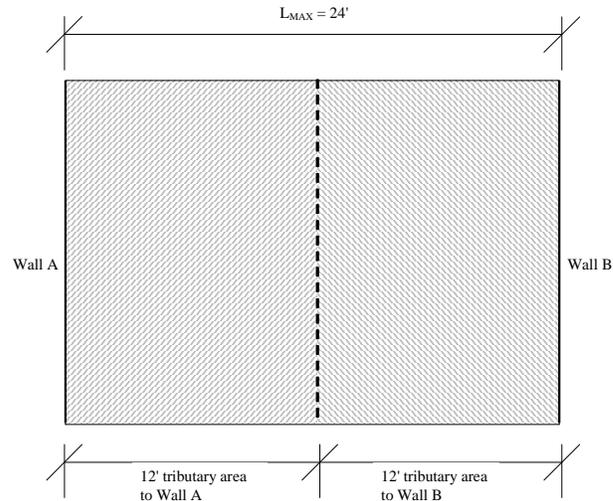
## Interior Shear Walls used to Resist Seismic Loads per the WFCM

What is meant by 2001 WFCM Section 3.4.4.2 regarding use of interior shear walls to resist seismic loads?

The last paragraph of WFCM Section 3.4.4.2 states:

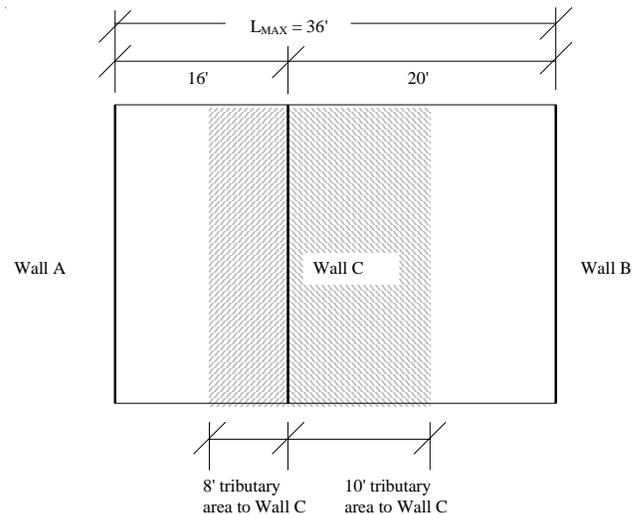
“Where interior shear walls are used to resist seismic loads, the full height sheathing requirements shall be determined using the spacing of exterior shear wall lines as the distance from the exterior shear wall line to the interior shear wall line, and the spacing of interior shear wall lines as the sum of the distances to shear wall lines on each side.”

WFCM Table 3.17C is the prescriptive table for determining segmented shear wall sheathing requirements for resisting seismic loads. The table shows maximum spacing of exterior shear wall lines ( $L_{MAX}$ ) and the corresponding percent of full height sheathing required. Tabulated values are based on tributary loads on shear walls. So, for example, if a 24' building has no interior shear walls, the underlying calculation is based on 12' of tributary area seismic load being distributed to each exterior shear wall and  $L_{MAX} = 24'$  as shown in Figure 1.



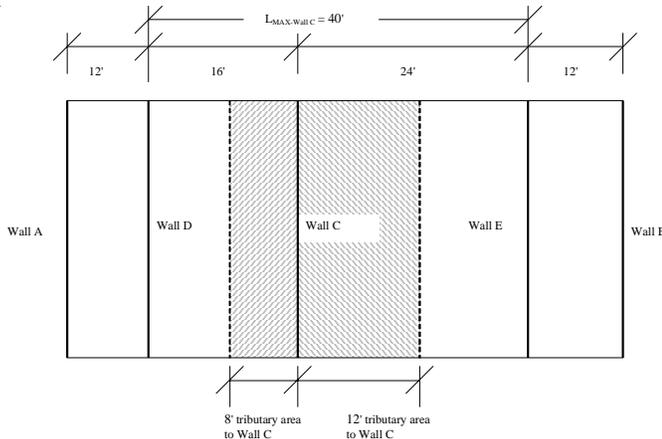
**Figure 1.** An underlying assumption for WFCM Table 3.17C is that tributary area ( $1/2 L_{MAX}$ ) seismic loads are distributed to each exterior shear wall.

If a building has one interior shear wall as shown in Figure 2, the underlying calculation for WFCM Table 3.17C is based on tributary area seismic loads being distributed to the interior shear wall as shown in Figure 2. In this case,  $L_{MAX} = 36'$  would be used in WFCM Table 3.17C to determine percent full height sheathing.



**Figure 2.** An underlying assumption for WFCM Table 3.17C is that tributary area seismic loads are distributed to the interior shear wall.

If a building has multiple interior shear walls as shown in Figure 3, the underlying calculation for *WFCM* Table 3.17C is based on the tributary area seismic loads being distributed to interior shear walls as shown in Figure 3. In this case,  $L_{MAX} = 40'$  would be used in *WFCM* Table 3.17C to determine percent full height sheathing for Wall C.



**Figure 3.** Underlying assumption for *WFCM* Table 3.17C is that tributary area seismic loads are distributed to each interior shear wall.

Similarly, if the distance between Wall A and Wall D is 12', in order to determine percent full height sheathing for Wall D, use  $L_{MAX} = 16' + 12' = 28'$  in *WFCM* Table 3.17C.

Finally, if the distance between Wall B and Wall E is 12', in order to determine percent full height sheathing for Wall E, use  $L_{MAX} = 24' + 12' = 36'$  in *WFCM* Table 3.17C.

## **Interior Shear Walls used to Resist Wind Loads per the WFCM**

Does the *2001 WFCM* permit use of interior shear walls to resist wind loads?

The engineering chapter of the *WFCM* does permit interior shear walls to be designed to resist wind loads. *WFCM* Section 2.4.4.2 states:

“Walls parallel to the applicable wind load or seismic motion shall provide the required shear resistance at each level. The sum of the individual shearwall segment shear capacities shall meet or exceed the sum of shear loads collected by horizontal diaphragms above. Total shear loads shall be calculated in accordance with Table 2.5-1 for wind or seismic motion perpendicular to ridge and Table 2.5-2

for wind or seismic motion parallel to ridge. Design loads shall be distributed to the various vertical elements of the seismic force-resisting system in the story under consideration, based on the relative lateral stiffness of the vertical resisting elements and the diaphragm.”

However, the designer must ensure that an appropriate load path is provided to distribute loads from the roof diaphragm into vertical shear walls. When wind loads are perpendicular to the ridge, this is fairly straightforward and guidance from the section on distributing seismic loads to interior shear walls could be used.

When wind loads are parallel to the ridge, using an interior shear wall to resist wind loads is more difficult. In order to transfer diaphragm loads, a vertical shearwall would need to extend past the ceiling to the roof level.

## **Interior Shear Walls per the Wind & Seismic Standard**

Does the *2005 Wind & Seismic* standard permit the use of interior shear walls to resist lateral loads?

The *Wind & Seismic* standard does permit interior shear walls to be designed to resist lateral loads. Since the standard does not differentiate between external and internal shear walls, it implicitly permits the use of interior shear walls to resist wind or seismic loads. As noted above, the designer must ensure that adequate load path is provided to distribute loads from the roof diaphragm into vertical shear walls.

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